B3 cont

a receiver coupled to the addressable controller to receive data corresponding to the alterable address and indicative of the predefined portion of the timing cycles; and

a vending machine illuminated by the light generated by the LED system.

B4

48. (Amended) The article of clothing of claim 45, further comprising a receiver for <u>receiving</u> data transmitted from an external transmitter.

REMARKS

Claims 1-50 are now pending. Applicants have amended the priority claim to more clearly set forth the relationships between the present application and earlier applications. The issues raised in the Office Action are addressed below in numbered paragraphs that correspond to the numbered paragraphs in the Office Action:

1. The drawings are objected to under 37 C.F.R. §1.83(a). Applicants submit herewith an amended drawing indicating the sensor, receiver, and transmitter set forth in claims 46 and 48. Applicants have also amended the specification to include references to the identification numbers of these elements. Applicants submit that these amendments are supported by the specification as filed, including the claims, and that no new matter is being added.

2-3. Claims 41 and 42 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite. Applicants have amended claims 41 and 42 to indicate that a device is being claimed, thereby obviating the grounds of the Examiner's rejection. Reconsideration is respectfully requested.

4-5. Claims 1-45 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Phares (5,420,482). Applicants respectfully traverse this rejection.

Phares teaches a controlled lighting system which comprises a plurality of light modules, each including at least two light elements and a control unit. However, contrary to the Examiner's assertions, Phares does not teach that the light elements are LEDs, as set forth in the pending claims. In the Background of the Invention, Phares cites two U.S. patents, R.E. 32,341

and 4,317,071, both of which relate to systems of electrical lamps, not LEDs. Phares never suggests using any other type of lighting element, such as an LED or semiconductor, in his disclosure. Moreover, Phares, which is a continuation of an application filed February 11, 1993, teaches employing blue, red, and green lighting elements. However, blue LEDs were not widely available prior to 1994 (see Appendix A, Savage, page 3, top), and would not have been suitable for the systems taught by Phares et al. because of their short usable lifetimes (Savage, page 2, bottom). Therefore, it would have been impracticable to employ LED light elements in Phares' lighting systems at the time that application was filed.

Furthermore, one of ordinary skill in the art reading Phares et al. would not have been motivated to employ LEDs in the systems taught by Phares. Neither Phares nor any other art cited by the Examiner teaches the use of LED lighting elements to illuminate an object, nor has any art been cited against the pending claims which teaches replacing traditional lighting elements with LED lighting elements, or which provides any motivation that would lead one of ordinary skill in the art to arrive at a lighting system which uses LEDs to illuminate an object with light of variable color. Accordingly, Applicants submit that a *prima facie* case of obviousness has not been established, and respectfully request that this rejection be withdrawn.

6. Claims 45-50 are rejected under 35 U.S.C. §103(a) as being unpatentable over Fitch (5,912,653). Applicants respectfully traverse this rejection.

Fitch teaches a garment bearing a color LCD panel capable of displaying video sequences. Claim 45 is directed to an article of clothing having an LED system controlled by a microprocessor. Fitch does not teach the incorporation of an LED system into a garment, nor that the LCD panel may be replaced by an LED system. Moreover, Fitch does not provide any motivation that would lead one of ordinary skill in the art to make such a substitution, as required by MPEP 2143.01. Although the Examiner alleges that one of ordinary skill in the art would use an LED system instead of the LCD system taught by Fitch to reduce the cost of the clothing, the cited art does not disclose any such motivation. In particular, the Examiner has not cited any art teaching or suggesting that replacing the LCD system with an LED system in an article of clothing would result in a reduction in cost. Applicants respectfully request that the references on which the Examiner may be relying be made of record. Otherwise, Applicants respectfully

request that the Examiner provide an affadavit pursuant to 37 CFR §1.104(d)(2), setting forth the personal knowledge which supports the present rejection. Absent such evidence, Applicants submit that the cited art would fail to indicate to one of ordinary skill in the art that it would be desirable to substitute an LED system for the LCD system taught by Fitch. Accordingly, Applicants submit that a *prima facie* case of obviousness has not been established, and respectfully request that this rejection be withdrawn.

CONCLUSION

For the foregoing reasons, Applicants respectfully request reconsideration and withdrawal of the pending rejections. Applicants believe that the claims are now in condition for allowance and early notification to this effect is earnestly solicited.

If there are any other fees due in connection with the filing of this Response, please charge the fees to our **Deposit Account No. 06-1448.** If a fee is required for an extension of time under 37 C.F.R. § 1.136 not accounted for above, such an extension is requested and the fee should also be charged to our Deposit Account.

Respectfully submitted,
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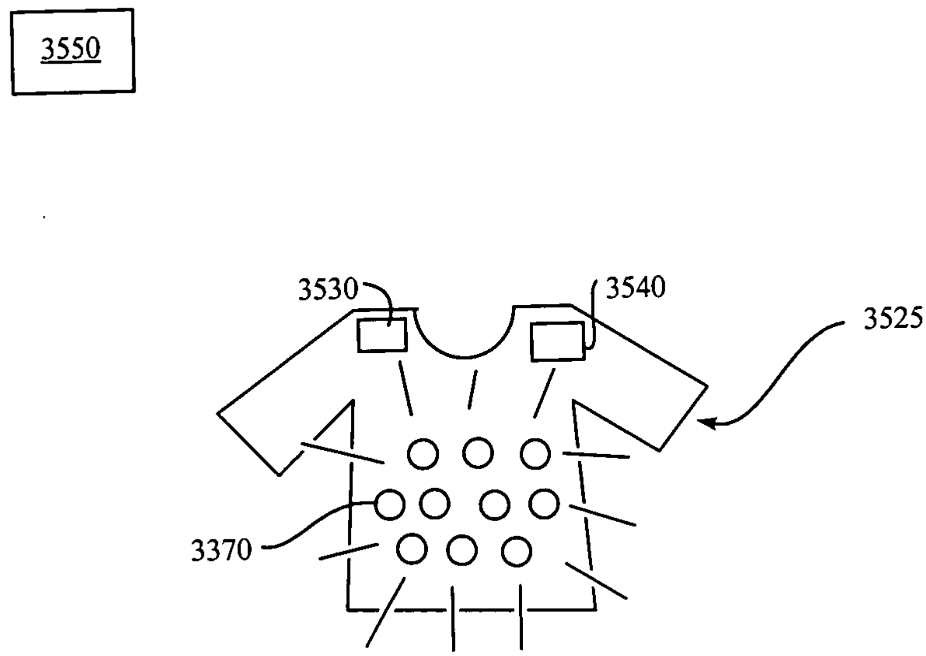


Fig. 100

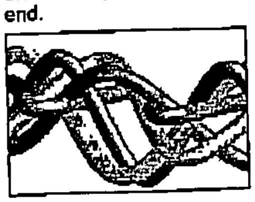
Almost blue

Scientists say they can improve the laser if they can find a way to turn it from red to blue

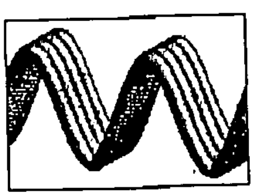
By Neil Savage, Globe Correspondent, 10/18/99

Since the laser's invention in 1960, movie villains from Dr. No to Dr. Evil have used lasers to threaten the world, or at least major cities. But researchers have since been hard at work looking for more useful applications of the technology - mainly for the good of humanity.

Different wavelengths of light correspond to different colors: red, at one end of the spectrum, has a wavelength nearly twice that of blue, at the other end.



Normal daylight includes waves of all colors, which together make white light.



Lasers emit light waves only in one frequency, all parallel and aligned so their peaks and troughs are synchronized.

Today, lasers are a familiar part of everyday life, used in everything from surgical instruments to supermarket checkout scanners to compact disc players. Of course, they are also used by the military in designing weapons of destruction.

But the hottest research in laser technology today isn't about blowing things up but finding a way to harness the power of a blue laser, which could lead to vastly increased storage capacity of CDs and DVDs (digital video discs), faster laser printers, and a better way to identify cancerous cells with blue light.

"I think they're going to be much more important in five years, or even less, than anybody has dreamed," said Fred Schubert, an engineering professor at the Boston University Photonics Center. Schubert, like others in universities and corporations worldwide, is working on better ways to build a blue laser.

Most semiconductor diode lasers - those in CD players and printers - are infrared, their beams invisible to the naked eye. The ones you can see, like those at the checkout counter or in laser pointers, are on the red end of the spectrum and have been around for years; think how long it's been since you junked your record player.

Red lasers are tiny chips of crystal the size of a small, square pebble. They put out bright, single-colored light a few thousandths of a watt in power. But lasers that shine blue have much shorter wavelengths and are difficult to make. A decade ago, researchers could make crystals that would emit blue light, but they'd only work for a few seconds before defects in the crystal would spread and put out the light.

Then along came Shuji Nakamura, a Japanese scientist who is the undisputed leader in blue laser development. By 1988 Nakamura had spent a decade working for Nichia Chemical Industries on the southern Japanese island of Shikoku.

It was Nakamura's job to get the right mix of elements and grow them into thin layers of crystal to make light-emitting diodes, or LEDs, which give off a colorful glow when a current is run through them. LEDs are the less-powerful cousins of lasers. The little green light that says the computer is on is an LED, and newer, brighter versions are showing up in traffic lights.

"I succeeded in that, but I failed in the sales, so my company was not happy with me," Nakamura said. Although he came up with better ways to make LEDs, every time he did, a bigger company like Toshiba would corner the market.

"I became desperate," he said. And in his desperation, he decided he had to convince Nichia to let him take a chance in a seemingly unpromising area. While researchers had produced blue light from gallium nitride crystals - made from a compound of the rare, brittle metal gallium and nitrogen - those had only lasted a few moments before the high power needed to run them caused the crystal to crack and go dark.

"In the past, always I wanted to do blue LEDs," Nakamura said. "But my boss said, `Oh, you cannot do blue LEDs, because it is impossible to do blue LEDs, because all the big companies have tried.' "

Yet he persisted, choosing gallium nitride mostly because no one else was working with it. With the blessing of the company's owner, and a generous research budget, he made marketable blue LEDs by 1994. And in January of this year, Nichia announced it had blue lasers available for testing in consumer products. Though it still needs work, gallium nitride is on the verge of doing for blue lasers what silicon did for computer chips.

The word laser is an acronym. It stands for Light Amplification through Stimulated Emission of Radiation. Light moves in waves, and sunlight or artificial light contains a mixture of wavelengths. By contrast, a laser is a beam of light that has a single frequency or wavelength.

The laser is created by subjecting a substance, such as a crystal or gas mixture, to energy in the form of strong light, electricity or a chemical or nuclear reaction. This excites the atoms of the substance, which emits light of a particular wavelength.

The advantage of a laser is that all the photons or particles of light have the same wavelength, so they're the same color, unlike, say, a flashlight, which gives off a whole range of wavelengths. With a tight, energy-rich beam, you can do useful things like cut metal.

A light's wavelength - the distance between the tips of two successive waves - determines the color that our eyes perceive. Wavelengths are measured in nanometers, or billionths of a meter. The average human hair is about 100,000 nm thick. The spectrum of the rainbow runs from roughly 400 nm for the violet end to about 750 nm for the red. Below 400 is ultraviolet light, then X-rays and gamma rays. Above 750 is infrared, then microwaves, then radiowaves.

A CD player uses an infrared laser with light at about 780 nm. That provides about 650 megabytes of room, enough to hold both sides of an LP with space for a few extra songs. A DVD player contains a red laser, emitting light of roughly 650 nm. That led to a capacity of about 4.7 gigabytes, room to squeeze on "Something About Mary."' A blue laser, in the 400 to 450 nm range, would yield about 16 gigabytes.

A DVD, with eight times the capacity of a CD, will hold about a two-hour movie. A DVD based on a blue laser could triple that. So you could fit the entire "Star Wars"

collection plus the soundtrack on one blue-laser DVD.

Video takes more space than still photos, and vastly more than text, so a DVD provides a lot of room for other uses. Microsoft already sells an encyclopedia with text, graphics and audio on CD. Utilizing the shorter wavelengths of blue laser beams, the company could fit 25 times the volume on one disc.

"Do we need a CD that has 3,000 songs on it? That's something hard to predict," said Schubert of Boston University.

Bob Steele, director of optoelectronics at Strategies Unlimited, a market research firm in California, looks at the capacity from the "if you build it, they will come" point of view. "It's the 'Field of Dreams' kind of philosophy. It wasn't too long ago that if your computer hard drive was one gigabyte, that was a big hard drive. Now you can hardly buy one that's less than six gigabytes," Steele said.

"As you go to shorter wavelengths, you get a big increase in data storage," said Steele. Steele's rough estimate is that the market for blue lasers for the next generation of DVD players alone will be worth a billion dollars early in the next century.

"We are taking advantage of the same feature, namely the shorter wavelength of blue light," said Noble Johnson, manager of the blue laser diode program at Xerox's Palo Alto Research Center, which is looking to design a laser suitable for use in the company's printers.

Blue lasers would give Xerox the ability to print with smaller dots, and to cluster more individual lasers together, giving better resolution and faster speed.

Jeffrey Manni, an engineer whose Burlington consulting firm helps develop laser-based medical products, said blue diodes could aid in the building of new medical devices. Already, dentists use blue light to cause fillings to harden or to whiten teeth. And chemical tags that fluoresce under the right wavelength can help find cancerous cells.

Researchers at Oak Ridge National Laboratory in Tennessee have developed a laser-based technique for finding cancer in the gastrointestinal tract. They thread an endoscope into a patient's stomach or colon and shine a blue laser light. Cancerous and precancerous cells

fluoresce differently than normal cells under this light.

Their device uses a large nitrogen laser, which costs $10,000 to $15,000, with a dye added to produce the blue light. A blue diode laser would cost thousands less to produce.

The military would like shorter wavelength lasers to apply similar fluorescence techniques for detection of chemical and biological weapons. And the right blue-green color allows underwater communication between submarines.

But making the lasers continues to be a challenge because gallium nitride "is very hard, very strong, but difficult to synthesize," said Schubert. It takes temperatures of about 1,000 C to grow gallium nitride crystals. Nakamura discovered a way to grow one so the defects didn't spread throughout it, and found that by working in a nitrogen-hydrogen atmosphere he could reduce the temperature to about 500 or 600 C.

"I was very lucky," Nakamura said, speaking by telephone from a recent California optics conference, where he had just told an audience that Nichia would start selling samples of a higher-power laser diode this month. The industry generally demands that a laser have a lifetime of at least 10,000 hours to be worth putting in a commercial device. Nichia's last about 2,000 hours. Not quite, but "it's very close," Nakamura said.

Despite the difficulties still to be overcome, scientists believe the widespread manufacturing of blue diode lasers is only a few years away.

Experts concede that the leader in the blue laser race continues to be Nakamura and that most of the blue lasers and devices based on them will likely be coming out of Japan.

"At the moment, the race is basically over," said Xerox's Johnson.

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